have put their best brains and energies into the cause of agriculture, with the result that their system of rural economics is a model to the world. The high standard of agricultural education is chiefly responsible for this success; it is significant that 20,000 Danish farmers possess covered manure sheds, while 90,000 have water-tight liquid manure tanks. But in comparing this state of affairs with conditions on our farms at home, it must always be remembered that our system of land tenure does not favour similar development here. It is not only ignorance that still causes so much of the fertilising value of farmyard manure to be lost by careless storage. The Danish farmer, owning his holding, is able to borrow from his credit society the capital necessary for these improvements; the English tenant farmer is not in the same position. Many landlords cannot provide these aids to successful farming, even if they realise that it is to their ultimate advantage to do so.

It is, however, to the rural high school that we must look as the real source of Denmark's present agricultural prosperity. It may surprise many to learn that no merely utilitarian outlook dominates these schools. On the contrary, they endeavour to show the power of history, poetry, and science, and of a higher level of life and thought to glorify ordinary workaday existence. How will a man trained in an atmosphere of this kind fill the place of a typical agricultural labourer on our farms? If Danish workers are introduced in any numbers into English rural life the results cannot fail to be of great interest.

THE CULTIVATION OF SPONGES.

An industry which promises a return of 3000 per cent. per annum on a very moderate capital expenditure is an attractive proposition. In the last issue of the *West Indian Bulletin* Mr. W. R. Dunlop describes the successful rearing of sponges from cuttings in the Caicos Islands, near Jamaica, and also the results of some earlier experiments in Florida. The sponges occurring naturally in West Indian waters have little commercial value, so that the material for planting must be imported. Although sponges are to a remarkable extent creatures of environment, and tend when transplanted to approach the native types in quality, there is evidence that this may not occur in selected localities in the Lesser Antilles. As the cuttings will only grow when attached to an anchorage, it is necessary to provide them with suitable means of support when planting out. Cement discs are used in Florida, to which the sponges are held by metal clips, but it has been found in the Caicos Islands that slabs of coral are quite as effective as the discs and naturally much cheaper. On soft or sandy bottoms a spindle is set in the disc to hold the cutting, otherwise the sinking of the disc tends to bury the sponge and kill it.

The crop is ripe for harvesting in from one to four years, according to the variety grown. To plant, harvest, and market one acre of sheep's-wool sponges costs about 4*l.* This is a large and valuable variety, taking four years to mature, and yielding 116*l.* per acre in the New York market. Assuming that one acre is planted each year, then, after four years, an annual expenditure of 4*l.* will yield an annual profit of 112*l.*, if four acres only are under cultivation. No charge for management is included in this estimate. The growers in the Caicos find that the small reef sponges, in spite of their lower market value, give an even better return on capital than the wool sponges, because they mature in twelve or fourteen months. It will be surprising if this industry, apparently so profitable, needs much official encouragement.

NATIONAL ASPECTS OF CHEMISTRY.[1]

Exactly seventy-five years ago from March 30, 1916, the Chemical Society met for the first time at the Royal Society of Arts after a preliminary meeting on February 23, 1841, at which it was decided "that it is expedient that a Chemical Society be formed." Though the society has continued to hold its anniversary meetings on or about March 30, ever since then, under various conditions, no meeting except that in 1915 has ever been held in circumstances at all approaching those now prevailing throughout the entire globe. The Crimean and Boer Wars did not awaken in the nation any appreciation of the increasingly important *rôle* played by chemical science in warfare. On the other hand, the enormous possibilities for the destruction of human life afforded by the application of scientific methods to warfare had inclined people to the belief that such a war as the present, with its ruthless disregard of life, could never occur. Short of demonstration, chemists would never have believed that their science could have been prostituted as it has been by the enemy.

Many thoughts arise in our minds on such an occasion as the seventy-fifth anniversary of our society, leading us to reflect on the state of chemical science before 1841, on the aims and purposes for which it was deemed expedient to form such a society, and to examine the measure of success that has been achieved by the society in fulfilling the objects as laid down in the charter.

Reference was made to various letters received from the founders of the society, and to one in particular from Henry Fox Talbot, the well-known pioneer in photography, expressing the view that the science of chemistry alone was not sufficient to engage the attention of a society, and suggesting that electricity should be added. How erroneous was this view is shown by the fact that within a month or so of its formation the Pharmaceutical Society was founded, and of later years, amongst other societies which have sprung from the parent society, may be mentioned the Society of Public Analysts, the Institute of Chemistry, and the Society of Chemical Industry, each of which has its important functions to perform.

Looking back to the time of the "father of chemistry and brother of the Earl of Cork," who in his introduction to the "Sceptical Chymist," stated "that of late chymistry begins, as indeed it deserves, to be cultivated by learned men, who before despised it; and to be pretended to by many, who never cultivated it, that they may not be thought to be ignorant of it," one may indeed wonder, on perusing our Parliamentary and legal reports, how our legislators should be classed in accordance with this statement, and to doubt whether the attitude of so-called learned men towards chemistry had done more than "begin" to change during the last two centuries. The beginnings of this change and the initiation of the experimental method into true science by Robert Boyle and his contemporaries followed closely upon the Civil War. For a hundred years or so onwards from the time of Boyle, the gradual substitution of careful experimental work in place of speculation on the reasons for chemical and physical changes added greatly to our knowledge. The rise and development of the phlogistic theory and its final overthrow by Lavoisier illustrate this phase in the growth of our science. The vast strides made in the progress of chemistry date back to the time when the use of the chemical balance was insisted on by Black; by its use chemistry became an exact science. Black's modesty and his devotion to scientific investigation for its own sake often led to his claim to be considered as the founder of modern chemistry being overlooked.

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[1] Abstract of the Presidential Address, entitled "Our Seventy-fifth Anniversary," delivered before the Chemical Society on April 6, by Dr. Alexander Scott, F.R.S.

The importance of chemistry to national existence was recognised in France as early as 1815, as is witnessed by the origin of the "Le Blanc Soda" process and the beet sugar industry in France. In our own country the electrolytic work of Davy and the discovery of benzene and of liquid chlorine by Faraday have formed the starting points of many of the manufactures of munitions and weapons of war now being employed, though more especially by the enemy.

Just as the Royal Society grew out of societies of a more informal nature, so the Chemical Society had as forerunners the Tepidarian Society, the Animal Chemical Society, and also a Chemical Society or Club to establish which an attempt was made in 1806.

From the very foundation of the society stress has been laid time and again, and by president after president, that it is upon the amount of research work carried out by its fellows that the reputation and true value of the society must depend. At the first anniversary meeting the council reported that it was "fully sensible that the utility of the society and its reputation in the scientific world will mainly depend on its publications." A curve was thrown on the screen showing the steady increase year by year in the number of original communications contributed to the Transactions, commencing at 42 (occupying 254 pp.) in 1841 and 1842, and reaching 272 (occupying 2909 pp.) in 1914. In 1905 the first volume of the annual reports on the progress of chemistry, initiated by Sir William Tilden, was published.

The president then dealt briefly with the progress made year by year by the society, referring more particularly to the jubilee of the society in 1891, and to the jubilee (in 1906) of the discovery of mauve. In 1876 a proposal to establish a research fund was revived, when Dr. G. D. Longstaff promised to give a sum of 1000*l.* if an equal amount were subscribed by chemists. With a like sum from the Goldsmiths' Company, together with donations from the Merchant Taylors' Company, the Mercers' Company, and the Clothworkers' Company, the research fund was placed on a sure foundation.

Reference was made to the importance of stimulating and encouraging research if we, as a nation, are to hold our own in commerce and manufacture. That it is the duty of everyone to do his utmost to wrest from nature her secrets is tacitly agreed to by all, but, unfortunately, there the matter rests. The apathy of the public to the vital importance of research is due in great measure to the fact that the so-called well-educated classes have no conception of what research means. The classical scholar pure and simple adds but little to the sum of human knowledge. He examines the knowledge accumulated in past ages, extracts what is buried there, much as a ploughman on the battlefield of Waterloo looks for a bullet fired a hundred years ago. He wonders by whom the bullet was fired, whom it hit, and other such matters, which, however interesting they may be, are of little use to anyone. The classic may retort by demanding of what use are many of our chemical researches? Let us look, therefore, at what research has done.

Research may be divided into two categories: (1) the mere addition of fresh knowledge to that already recorded: of fresh mastery over the powers of nature and of new ways of utilising energy; and (2) the definite quest for the solution of a particular problem, it may be the manufacture of something occurring in nature or of something which shall have definite properties. The experiments of Cavendish on the composition of the atmosphere when he converted nitrogen and oxygen into nitric acid are typical of the first class of research. From this discovery an industry of vast importance to the world, the utilisation of atmospheric nitrogen, has sprung up in Norway, America, and Switzerland. Moissan's researches into the reactions at temperatures producible by means of the electric arc led to the production of many new compounds, including calcium carbide. These two industries have been established as the result of experiments made solely to increase our knowledge. Who could have foreseen what the discovery by Faraday of benzene in oil-gas would lead to at no distant date?

As examples of the second type of research may be mentioned the researches which led to the synthesis on a manufacturing scale of alizarin and of indigo, and to those which led Ehrlich to the discovery of salvarsan.

Broadly, there are two types of chemists who enlarge our knowledge: the one who feels that he can best fulfil his life's purpose by devoting himself to the discovery of new laws and new substances for the simple purpose of increasing the store of general knowledge so that those who follow after may reap the benefit of his labours. For such a man the reward is too often only the joy of having succeeded in his aim, well knowing that the money prizes attached to the application of his discoveries to industry will not be his. The other type is the man of practical bent who is always striving to apply the knowledge of the laws of nature and of the properties of substances to the solution of definite problems which confront the chemical manufacturer, the engineer, and others. Both types of men must be trained in the most thorough manner possible in the universities, and be taught how to tackle both theoretical and practical problems in a scientific manner.

The manufacturer is prone to expect his research chemist to indicate almost immediately the value of his presence in the works by a visible increase being shown in the profits. It is by no means a rare thing for a chemist employed at a miserable salary to be consulted in the same way as a specialist who is called in to see the patient on his death-bed. Had the aid of the chemist been sought earlier he, like the specialist, might have been successful in achieving the desired object. If the chemical manufacturers are not only to hold their own, but are to save themselves from extinction, there is only one remedy: they must seek the services of the man with a broad and sound foundation of the facts and theories of the day, and with a thorough training in the methods of advancing knowledge. Merely to maintain the dead-level of a fair measure of success is an existence which can only satisfy a decadent race, and this war has shown the British race to be as full of energy, bravery, and chivalry as of old.

The nation is now learning day by day what neglect of science has meant to it, and our legislators are having the importance of science forced upon them. Perhaps no branch of scientific knowledge has been more appreciated for the time being than chemistry, though it has required hundreds of thousands of tons of T.N.T., lyddite, and dynamite to shade the foundations of their ignorance.

The newspapers and scientific journals have laid bare the defects of our education, more especially with reference to our scientific education. It is obvious that if the manufacturer is to employ properly trained chemists, he must be provided with an adequate supply not only of men trained in what are known phenomena, who may be mere walking encyclopædias, but of men who are trained to attack problems.

There are, however, many points which our newspaper correspondents overlook when casting blame on the various educational authorities for their shortcomings. Much difficulty was experienced by headmasters in obtaining men who could teach and keep order in a class. Often the man who taught science in school did so as junior mathematical master because his other teaching duties were lighter than those of his colleagues; but his knowledge of the subject might be but little deeper than that of the scholars he was instructing.

Where schools have been fortunate enough to secure properly trained science masters, the masters have usually to prove their value to the school, not by sound, all-round teaching, but by devoting much time to coaching-up the brilliant boys to win scholarships. Owing to the absurd nature of many of the questions set at the open scholarship examinations, candidates are forced to read and "get-up" quite specialised branches of work of far too advanced a nature, instead of devoting themselves to acquiring a sound knowledge of the principles and experimental data and their relations to the fundamental principles of science. Again, the successful scholar, say, in chemistry, is usually too proud of his position to go to a course of lectures on general chemistry by the professor, but prefers to attend special courses on advanced subjects, and thus become a specialist long before he should, suitable, perhaps, to hold a fellowship of his college, but almost as unfitted as his fellow-classic for active and useful life in an industrial centre and for facing industrial problems.

The brilliant youth who goes to Oxford or Cambridge, and whose ambition it is to lead the life of a student, is taught to regard the fellowship of his college as the greatest prize at which he can aim. Although the college authorities may state that the chances of gaining a fellowship are open equally to a science and to a classical student, this is not the case, for the simple reason that the electors to fellowships are, in almost all colleges, mainly classical men, who, however fair-minded they may be, are unable to estimate the value of that which they do not understand. Again, in some cases, all the fellowships which a college may devote to natural science are given to one branch.

What are the prospects of a brilliant schoolboy who takes up chemistry as his subject, and, after gaining a scholarship, obtains the highest possible places in the honours examination? If he be elected to a fellowship and decide to remain and take his part in the college life, his income as a fellow can only be regarded as a mere pittance if he is devoting himself to real research work. He may do fairly well at the Bar now that scientific opinion is more frequently sought in patent cases than it was; but no prize equal to the bishopric offered to members of the clerical profession can be his. There is no chance for him to hold any high Government office, for all the Civil Service examinations, whether at home or abroad, are heavily weighted in favour of the classical and mathematical candidate. Everything of a nature to test a man's ability to tackle an unknown problem, however simple its nature, is carefully excluded by cautiously worded syllabuses which detail the range of the facts and the nature of the tests which may be applied.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

We learn from the issue of *Science* for March 17 that in the will of the late Mr. R. R. Rhodes, of Cleveland, Western Reserve University, through its medical school and affiliated institutions, is a beneficiary to the amount of about 100,000*l.*; and that the will of Marie Antoinette Fisk, of Pasadena, Cal., gives 10,000*l.* to Princeton University.

Mr. Arthur Du Cros, M.P. for Hastings, has generously promised a gift of 7000*l.* to the Extension Fund of the London (Royal Free Hospital) School of Medicine for Women, thus completing the 30,000*l.* for which appeal was made. The appeal was first put forward in December, 1914, so that the sum has been subscribed in sixteen months. There have been more than twelve hundred subscribers, which is satisfactory as showing wide sympathy with the work of medical women. Next to Mr. Du Cros's generous gift, the largest subscription is 3000*l.* from Mrs. Garrett Anderson. The extension of the school is approaching completion, and will be opened in October next. It is indispensable to the increasing demands made upon the accommodation of the school, as another large entry of students is expected next session.

The annual report on the work of University College, London, which has now been published, deals with the period February, 1915–February, 1916, and includes financial statements for the session 1914–15. The total number of students who registered during the session 1914–15 was 1416, being a decrease of 790 compared with the preceding session. During the session 335 men students withdrew to join H.M. Forces, and forty-three other students to undertake some other recognised form of national service connected with the war. The total fees available for 1914–15 amounted to 18,936*l.*, a decrease of 9775*l.* on the prevous session. There has been a further decrease, both in the number of students and in fees received for the current session. The financial result in the course of two sessions is that the fee revenue has declined by some 24,000*l.* The position has been relieved by Treasury grants of 10,500*l.* for the sessions 1914–15 and, 1915–16, and economies to the extent of about 9000*l.* will reduce the probable deficit at the end of the current session to 3500*l.* A very gratifying number of war honours obtained by members of the college are chronicled in the report. There are now sixty members of the academic and administrative staffs absent on war service.

The appointment of a Royal Commission on University Education in Wales is announced. The terms of reference of the Commission are as follows:—To inquire into the organisation and work of the University of Wales and its three constituent colleges, and into the relations of the University to those colleges and to other institutions in Wales providing education of a post-secondary nature, and to consider in what respects the present organisation of university education in Wales can be improved and what changes, if any, are desirable in the constitution, functions, and powers of the University and its three colleges. The following are the names of the persons appointed to serve on the Commission:—Lord Haldane (chairman); Prof. W. H. Bragg, Quain professor of physics, University of London; the Hon. W. N. Bruce, a principal assistant-secretary under the Board of Education; Sir Owen M. Edwards, chief inspector, Welsh Department, Board of Education; Dr. W. H. Hadow, principal of Armstrong College, Newcastle; Mr. A. D. Hall, a Commissioner under the Development Act; Sir Henry Jones, professor of moral philosophy, University of Glasgow; Sir William Osler, Bart., regius professor of medicine, University of Oxford; Miss Emily Penrose, principal of Somerville College, Oxford. The secretary to the Commission is Mr. A. H. Kidd, of the Board of Education, to whom all communications should be addressed.

The earnest appeal on behalf of the children which appeared in the *Times* of April 17 over the signatures of some of the most distinguished women of the